McGill Bird Observatory
Field Protocol for Migration Monitoring Program

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A project of the

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Table of Contents

List of Figures

List of Tables

1. Introduction

McGill Bird Observatory (MBO[1]) is a member of the Canadian Migration Monitoring Network (CMMN), located on private property with restricted access, at McGill University's Stoneycroft Wildlife Area in Sainte-Anne-de-Bellevue, Quebec (45.431°N, 73.939°W; Figure 1). It was established as a project of the Migration Research Foundation (MRF) in 2004 and has operated under this protocol (with minor modifications) ever since.

The purpose of the Migration Monitoring Program (MMP) at MBO is to obtain data on neotropical migrant and other landbird species in a scientifically rigorous manner, to contribute to national and continent-wide efforts to monitor population trends, as well as to conduct other scientific research while training future banders.

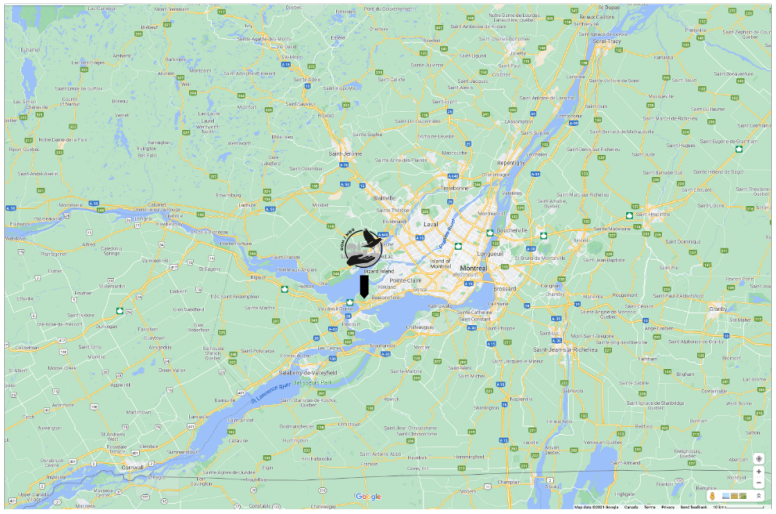


***Figure 1**: Location of McGill Bird Observatory near the west end of the island of Montreal*

As this protocol is intended to be a practical field manual, it emphasizes the procedures to be followed, but places little emphasis on why particular approaches have been chosen. The general philosophy and basic recommendations for operating a migration monitoring program are explained in detail in Blancher *et al.* (1994) and Hussell and Ralph (1996). Additional information about MBO programs and its participation in the Canadian Migration Monitoring Network are available on the MBO website, www.oommbo.org.

This written protocol for MBO is designed to guide the application of generally accepted principles of migration monitoring, and to detail procedures that are specific to the monitoring program at MBO. A written protocol is necessary to ensure that staff follow the same field methods and data management procedures from day to day and year to year despite changes in personnel. Additional details regarding the basic operation of MBO are summarized in the MBO Operations Manual (Gahbauer and Duval 2022).

[1] Because an older bird observatory in the U.S. also uses the 'MBO' acronym, 'MGBO' is the code used by CMMN for the Canadian site in many data bases and reports.

2. Programs

The MMP consists of standardized banding and census, general observations of birds, and generation of a standardized Daily Estimated Total (DET) for each species for each day covered by the program. The resulting data are archived with Birds Canada and made available to researchers through the NatureCounts website. This protocol specifically addresses the operation of the spring and fall MMP:

- **Spring MMP:** This program covers all days during the 10-week period from March 28 to June 5 of each year. Banding is limited to a 45-day period from April 18 to June 1, due to lingering snow and cold temperatures common during the first three weeks of the season, and breeding species beginning to dominate by early June.
- **Fall MMP:** This program covers all days during the 14-week period from August 1 to November 6 of each year (previously 13 weeks, ending on October 30, until 2014). Banding occurs daily throughout the season, unless limited by weather.

No artificial food sources are to be provided during migration monitoring, other than a hummingbird feeder near the cabin. Capture of hummingbirds at this feeder is conducted only when a qualified bander and sufficient capacity are available. Location of the feeder does not interfere with standard data collection. Birds captured at this feeder during the standard period are recorded as casual observations and are included in the DETs.

The basic principles of this protocol (especially safety and record-keeping) also apply to other MBO field programs, but those are either governed by other guidelines (e.g., MAPS) or may be operated in a less standardized manner based on limitations in staffing or weather restrictions.

- **Summer bird monitoring:** This is primarily undertaken following the standard MAPS protocol (Desante 2020), including banding on seven occasions (approximately ten days apart) between June 6 and July 31. It is supplemented by monitoring nest boxes on site and associated casual observations.
- **Winter bird monitoring:** Non-standard banding and casual observations as weather (especially temperature) and staffing permit during the 21 weeks from November 7 to March 27. The program primarily targets species attracted by feeders: northern finches and resident species such as Black-capped Chickadee, Northern Cardinal, woodpeckers, and nuthatches. Feeders are located at 45.430086°N, -73.938235°W.
- **Northern Saw-whet Owl monitoring:** This program covers all nights with suitable weather during the 6-week period from September 26 to November 6.

3. Staffing

Aside from the Bander in Charge (BIC), all other participants in the MMP are generally volunteers; all personnel including the BIC are collectively referred to as "staff" in this protocol. The MMP is designed to be run by a minimum of three staff reasonably experienced with migration monitoring and with MBO protocol. At least one of them must be a licensed bander capable of acting as a BIC, and at minimum one other must be a sufficiently good birder to run the standardized census. However, to achieve full coverage (*see Section 11 – Coverage codes*), at least three reasonably experienced "Class 1" birders (see Table 1) are required, and two or more people skilled in mist-net extractions (although these can be the same individuals, i.e., if the extractors are also Class 1 birders, they can fill both roles).

Table 1: *Observer classes*

Class	Criteria
1	Can correctly identify >75% of species likely to be encountered at MBO based on a good view for 5-10 seconds without recourse to a field guide
2	Can correctly identify 50-75% of species likely to be encountered at MBO based on a good view for 5-10 seconds
3	All other active observers

Additional staff make it easier to run the program and can help with tasks such as scribing and obtaining better coverage of the study site. Staff not essential to the banding program at any moment are encouraged to be outside observing. If insufficient staff are available on a particular day to run the full protocol (i.e., to run all net groups plus the census) the **top priority is the census** followed by as many net groups as safely possible (*see Section 5 – Net locations*) with general observations being the lowest priority. When rain or high winds make banding unsafe, staff should spend their time making general observations.

At the beginning of each day, staff are assigned responsibilities by the BIC that do not exceed their skills, knowledge, and experience. Detailed descriptions of the BIC's role and the many jobs that volunteers carry out are found at: http://www.oommbo.org/how-to-help/volunteering/job-descriptions/. As the title implies, the BIC is in charge, and responsible for the designation and supervision of tasks. All staff must follow the BIC's directions. Prior to participation, all staff must familiarize themselves with this Protocol and the Bander's Code of Ethics (see Appendix A). Bird safety always comes first. ***Volunteers new to banding should not expect to handle nets or birds until proper training has occurred.***

Training to improve skill levels can be undertaken on an ongoing basis, although it may need to be suspended during particularly busy periods when the BIC is required to devote full attention to banding quickly to avoid a backlog of birds from accumulating. Specific training opportunities should be scheduled away from the peak of migration. Internships are best scheduled in spring when the pace of migration tends to be slower but fall internships may also be arranged if they begin in August so that the participant has sufficient experience by mid-September to contribute during the peak of migration. Visitors unfamiliar with banding or the MBO Protocol should be scheduled only when sufficient fully trained staff are available to show them the site and explain the program.

All volunteers are expected to conduct themselves with respect for each other, the birds, and the site. Any concerns regarding inappropriate behaviour should be reported in person to the Bander-in-charge or via e-mail to mbo@migrationresearch.org, if appropriate, or else to the Executive Director of the Migration Research Foundation (Marcel Gahbauer, marcel@migrationresearch.org). All reports will be addressed confidentially.

4. Count Area

The count area consists of all areas north of the access road, west of the fence running along the agricultural field, south of the Morgan Arboretum fence line and east of the Morgan Arboretum Road (Figure 2). For the purpose of the census, general observations and DETs, all birds visible or audible from within this area are countable, no matter how far outside the zone the bird is. If an observer is outside the count zone, no birds detected as being outside or inside the zone are countable.

5. Net Locations

The MMP has used a standard set of 16 nets allocated to groups A, B/N, C, D, E, and H since 2008 (see Figure 2). Minor differences in previous years are detailed in section 16. GPS points of precise locations for the standard long-term nets are listed in Appendix B

Group A consists of 2 nets among apples and hawthorns, a bit inland from Stoneycroft Pond. Group B/N consists of 4 nets along the eastern ridge of the rear pond. Group C consists of 2 nets in the sumac grove running along the north edge of Stoneycroft Pond. Group D consists of 4 nets along the east edge of Stoneycroft pond, three of them parallel to the shore, and the other perpendicular to it. Group E consists of 2 nets along the edge of the centre field, one partly lined with conifers, and the other among hawthorns. Group H consists of 2 nets among tall shrubs near the banding station, with one perpendicular to the south end of the rear pond, and the other near the windmill, parallel to the main trail toward Stoneycroft Pond.

There are four other sets of nets at MBO used for programs outside the MMP. Group M (M1-M9), scattered around the south half of Stoneycroft Pond, has been used since 2009 for the MAPS program. Group O (O1-O4 and O6; formerly also O5) at the edge of the centre field is used for owling (along with E1 and E2) and was also established in 2009. Group V (currently V3-V5; formerly V1-V2) is around a hawthorn thicket near the north end of the centre field are used for winter banding.

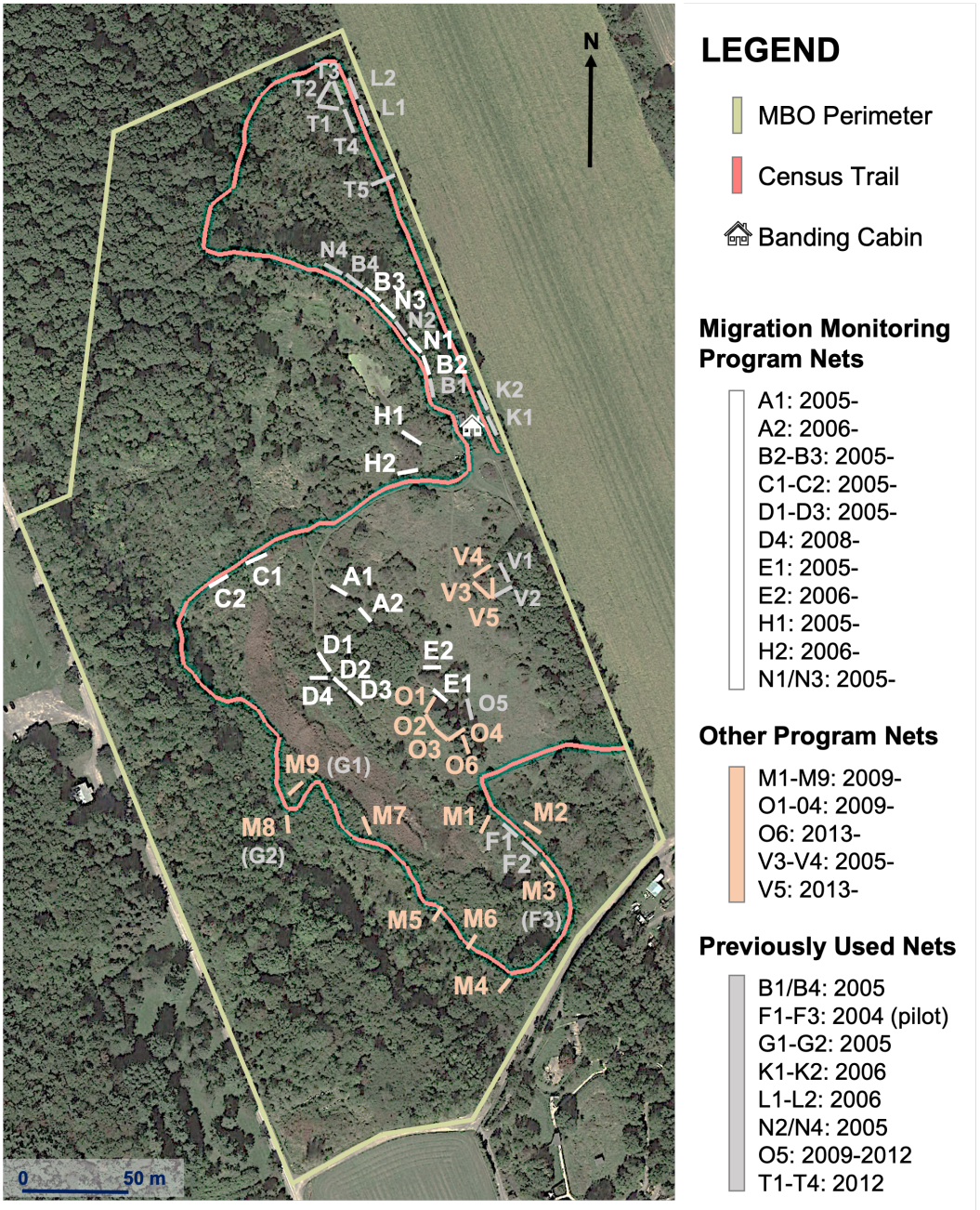


***Figure 2**: Map of McGill Bird Observatory, indicating census trail and net locations.*

All passerine nets are four-shelf tethered Japanese nylon nets with 30 mm mesh deployed to a height of about 2.5 m. The O nets are four-shelf tethered Avinet nylon 60 mm mesh. Since 2012, all nets have been purchased from Avinet Research Supplies (known as Manomet until 2016); prior to that Spidertech nets were used, but the change was required when their supply became unreliable. Efforts should be made to avoid further changes to nets, as the capture rates likely vary by model. All nets are 12 metres long.

Generally, all nets in a group are to be opened and closed at the same time, unless wind necessitates the closing of some nets while others remain unaffected. Opening and closing times are recorded on the log sheet for each net group. Captures are recorded on the data sheets by specific net, not by group. If the capture location for a particular bird has been forgotten or confused, the location should be left blank. Location for any birds captured in nest boxes should be left blank, with the box number noted in the comments.

The BIC is responsible every morning for determining which nets are to be used. For MMP, this should generally correspond to one of the following 3 options, with the choice dependent mostly on weather and the capacity to manage the volume of birds expected:

- **Full**: All nets (C, A, D, E, B, N, H)
- **Basic**: All nets except B/N (i.e., C, A, D, E, H) – typically on windy days, especially in late fall when the B/N nets can rapidly fill with leaves
- **Limited:** Only H and C, A, E, or even fewer as necessary

In practice, full operation is standard, with basic operation rarely more than a few times per month, and limited capacity at most a few times per season. If wind or other circumstances (e.g., presence of a predator) present safety concerns, net groups should be closed as necessary, and noted in the daily log.

When the volume of birds is high, the BIC can assign each extractor a set of nets for which they are responsible, according to the protocol as described above. On every net round, each extractor (and their assistants) should complete a loop of all nets within their assigned sector. One person within each team must always carry a walkie-talkie or cellular phone and report back to the BIC after their sector is checked.

6. Daily Count Period

The daily count period begins 30 minutes before sunrise and concludes 6 hours later. If weather conditions permit, nets start to be opened when the count period begins and start to be closed 5 hours later. Nets should generally be closed in the same order in which they were opened. Table 2 summarizes the schedule of key events during the count period. Note that net opening hours are not to be extended even if cold, rain, wind, or other inclement weather prevents them from being open for part of the standard period.

The tally of DETs (*see Section 11: Daily Estimated Totals*) cannot begin until all birds captured in the closing net round have been processed. Any birds detected after the count period ends must be excluded from DETs, although any of interest (i.e., not previously detected during that day's count period) should be noted on the daily log. If any banding is to take place after the count period, the DET tally must be completed before the non-standard activity begins.

Table 2: *Summary of key events during count period in relation to sunrise*

Event	Time	E.g. 1: May 31	E.g. 2: Sept. 18
Count period begins and nets start being opened	0.5 hour before sunrise (rounded to 5 minutes)	4:50 am	6:00 am
Sunrise (all nets open)	Sunrise	5:18 am	6:30 am
Census starts	1 hour after sunrise	6:20 am	7:30 am
Census ends	2 hours after sunrise	7:20 am	8:30 am
Nets closed	5 hours after sunrise	10:20 am	11:30 am
Count period ends	5.5 hours after sunrise	10:50 am	12:00 pm

7. Safety

a) Bird Safety

All banding activities must be operated with the welfare of the birds as the top priority. In addition to ensuring that they are handled with care, special consideration should be given to the following aspects:

i) Temperature and other weather limitations

As a general rule, the mist nets should not be operated below -5°C, or above 25°C. Extra care should be taken near either of these temperature extremes – i.e., more frequent than usual net checks (every 10 minutes in winter and every 15 minutes in summer). In winter, the cut-off temperature

should be even higher when there is wind (i.e., the wind chill temperature should be used as a guideline), and in summer, nets in full sun should be closed or monitored almost continuously when the temperature rises above 25°C.

ii) Extraction

The greatest potential for injury to birds occurs during extraction, and for this reason only those who have demonstrated a consistent high level of competence with extractions should be permitted to conduct them without supervision. Extraction is not for everyone, and it is up to the BIC and/or MBO Coordinator to decide whether a particular volunteer should be encouraged to focus on observation or scribing instead of training as an extractor. Those who do have good skills as extractors should be encouraged to assist with training newer volunteers who show a potential aptitude. New volunteers with previous extraction experience will need to demonstrate their skills before they are allowed to extract. A detailed set of instructions and tips for extractors is posted on the website at www.migrationresearch.org/mbo/extraction.html

iii) Carrying birds

Once extracted from the net, each bird must be gently and safely secured in a cotton bag and carried back to the banding station. (See section 9 on keeping track of nets from which each bird was extracted.) Care must be taken to ensure that the birds are safe throughout this time. Specifically, those carrying birds must make efforts to minimize jostling of bags as they carry them, and to keep large and/or jumpy birds separated from others as much as possible. Bird bags may be clipped to shoulder bags or belts, but if so, extra care is required to ensure the birds are not brushed against vegetation while walking. However, the best/safest way to carry birds in bags is in the hand (which is extended out perpendicularly, in front of the body), with the bag strings looped over the wrist or fingers. This ensures that the carrier knows where the bags are at all times and permits easy maneuvering around obstacles.

iv) Frequency and thoroughness of net checks

Each net should be checked at least every 30-45 minutes. At the beginning of the day, the BIC will write the time of each net round on a white board on the outside of the cabin. Volunteers, in particular banders or lead extractors should refer to this often during the morning. If weather conditions are at all unpleasant (windy, humid, particularly cool or warm), nets should be checked at least every 30 minutes, and there is no harm in checking this often under any conditions. On each check, every net should be inspected carefully from end to end, paying particular attention to the

lower and upper panels where birds may be easier to miss, to ensure that no small birds are overlooked.

v) Holding Times

Birds should be processed as quickly as possible, preferably within 10 to 30 minutes. However, birds can remain healthy in shaded bags for up to an hour, given that they are not subjected to excessive heat or cold. Brooding females should be flagged as priorities for immediate processing.

vi) Priority birds

Brooding females and juveniles should be flagged as priorities for immediate processing. In addition, preference should be given to any birds that appear to be experiencing undue stress of any kind, including those for which extraction was unusually complicated or prolonged. The BIC should be notified of any such birds when they are delivered to the banding station.

vii) Priority if busy

If the number of birds waiting for banding begins to accumulate, the BIC is responsible for adjusting the process to ensure that no birds are held for longer than one hour. When a second qualified bander is available, they should be asked to assist with clearing the backlog; ideally each bander would work in tandem with a separate scribe, but an experienced scribe can work with both banders concurrently. If a second bander is not an option, or that alone is insufficient to catch up, reduce the amount of data collection by omitting fat and weight, and if necessary, even wing chord (*see Section 9: Banding protocol*). If the volume of captures remains at a high level for two or more rounds and banders are unable to keep up, proceed to close some nets, beginning with B/N, then C if necessary, to streamline the net round route as much as possible. In exceptional circumstances, if the volume of captures remains unmanageable despite the above measures, release birds unbanded, but keep note of the species (and if possible sex).

viii) Communication

The BIC is expected to always keep a cellphone close. The lead extractors should have the number of the BIC and be ready to communicate through text message or call-in case of emergency. In addition, two-way radios can be used on busier days for communication among volunteers.

b) People Safety

i) First aid

A basic first aid kit (bandages, alcohol, etc.) and an automated external defibrillator (AED) should always be kept in an easily accessible place within the banding station. The Coordinator and BIC are responsible for maintaining it.

ii) Sanitation

Working with wild animals of any kind requires that some basic sanitary precautions be taken. At a minimum, all participants who handle birds or bird bags should ensure that they wash their hands prior to touching any food. A disinfectant hand gel and/or disinfectant hand-wipes should be kept at the banding station.

iii) Campus Security

The BIC should have the telephone number of Campus Security on his/her telephone. The number is also displayed in the cabin (514-398-7770).

iv) Facilities Maintenance

Prior to the start of each MMP season, the cabin should be cleaned. The chimney of the wood stove should be cleaned a minimum of once a year. Storage containers, which should be labelled with their contents, should be checked to see if there has been rodent or other damage. The wiring between the solar panel and battery should also be verified as well as the MOTUS system on the old windmill.

v) Fire Extinguisher

A fire extinguisher is hung in a visible and accessible location at the cabin. It is the responsibility of the BIC or Coordinator to ensure that it is verified once a year. In the event of an uncontrolled blaze, 911 should be called as well as Campus Security (514-398-7770).

8. Bird Bags

Small and medium-sized birds are placed in cotton bags for transport from the nets to the banding station. Hawks and other large birds, or birds that may be tricky to remove from the bag (e.g., shrikes), should instead be brought directly to the banding station without being bagged. To minimize the risk of spreading disease between birds, bags should be used at most twice (once, then turned inside out and used again unless soiled after the first use) and then washed in hot, soapy water.

The key requirements of bird bags are that they are made of cotton, do not have any loose seams in which birds can get tangled, and have a drawstring that slides easily to facilitate quick and reliable opening and closing. Size can vary somewhat, with smaller bags being preferable for little birds such as kinglets and warblers, and larger ones required for thrushes and blackbirds. Guidelines for the design of bird bags are posted on the website at www.migrationresearch.org/birdbags.pdf.

9. Banding Protocol

The standard references for identification are Pyle (2008) and Pyle (2022), and for non-passerines also the *North American Bird Banding Techniques* (Canadian Wildlife Service and U.S. Fish and Wildlife Service, 1991). Data routinely recorded for all captures are listed below (see also Figure 3) but note that if accelerated processing is required at peak times to avoid a backlog, fat and weight (and even wing chord) can be omitted.

- band number
- species
- age and how aged (see Appendix C for skulling codes)
- sex and how sexed
- unflattened wing chord
- presence and extent of fat (see Appendix C for fat scoring codes)
- weight
- date
- time of banding
- initials of bander
- location of capture (2-digit net code)*
- probable age or sex if uncertain (Prob A & S)
- initials of scribe
- comments (any ad ditional relevant information, e.g. feather loss, ticks, etc.

** Note that extractors are responsible for identifying which net each bird was captured in. When volume is low, this can be done through hanging each bag on the corresponding net peg inside the banding cabin. At busier times, extractors or net assistants are encouraged to clip the labeled clothespins found at the nets to the string of bird bags from a particular location, to ensure they can then be placed correctly at the banding station.*

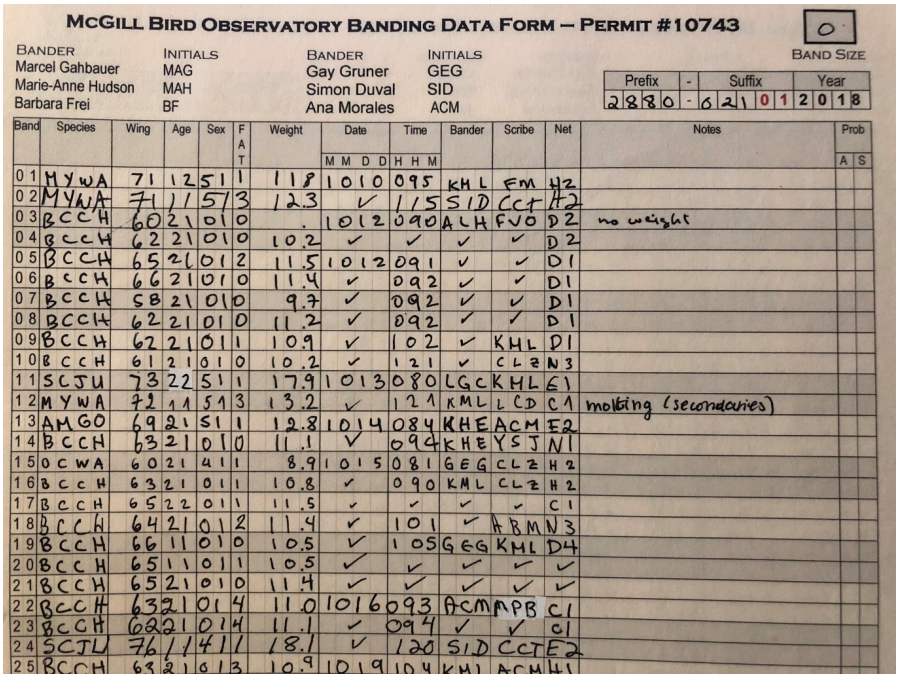
Banders should routinely check for cloacal protuberance (CP) and brood patch (BP) during spring migration and the breeding season and should always attempt to age individuals. Atypical moult patterns should be documented by photography and notes.

In addition, if time permits and at the discretion of the BIC, the following information may be recorded. However, this supplementary information should not be recorded routinely if doing so would require other elements of the protocol to be scaled back.

- presence and nature of parasites
- molt card for species known to be molt migrants.
- any additional species-specific measurements (e.g., flattened wing chord of Tree Swallows; wing formula for Bicknell's Thrush or Willow Flycatcher)

For birds that are recaptures from a previous day, the regular set of measurements will be taken unless doing so unacceptably delays the processing of new birds. Birds that are captured for a second or additional time on the same day are released without further data being collected unless the bander wishes to revise or supplement data taken earlier.

If a bird is injured and neither recovers immediately nor seems to require euthanasia, it should be taken to Le Nichoir after calling to notify them in advance (450-458-2809).



McGILL BIRD OBSERVATORY BANDING DATA FORM – PERMIT #10743

BAND SIZE: 0

BANDER	INITIALS	BANDER	INITIALS
Marcel Gahbauer	MAG	Gay Gruner	GEG
Marie-Anne Hudson	MAH	Simon Duval	SID
Barbara Frei	BF	Ana Morales	ACM

Prefix: 2830 - Suffix: 621 01 - Year: 2018

Band	Species	Wing	Age	Sex	FAT	Weight	Date (MMDD)	Time (HHMM)	Bander	Scribe	Net	Notes	Prob A	Prob S
01	MYWA	71	12	51	1	11.8	1010	0955	KHL	FM	H2			
02	MYWA	71	11	51	3	12.3	✓	1155	SID	CCT	H2			
03	BCCH	60	21	01	0		1012	0900	ALH	FVO	D2	no weight		
04	BCCH	62	21	01	0	10.2	✓	✓	✓	✓	D2			
05	BCCH	65	21	01	2	11.5	1012	0911	✓	✓	D1			
06	BCCH	66	21	01	0	11.4	✓	0922	✓	✓	D1			
07	BCCH	58	21	01	0	9.7	✓	0922	✓	✓	D1			
08	BCCH	62	21	01	0	11.2	✓	0922	✓	✓	D1			
09	BCCH	62	21	01	1	10.9	✓	1022	✓	KHL	D1			
10	BCCH	61	21	01	0	10.2	✓	1211	✓	CLZ	N3			
11	SCJU	73	22	51	1	17.9	1013	0800	LGC	KHL	E1			
12	MYWA	72	11	51	3	13.2	✓	1211	KML	LCD	C1	molting (secondaries)		
13	AMGO	69	21	51	1	12.8	1014	0844	KHE	ACM	E2			
14	BCCH	63	21	01	0	11.1	✓	0944	KHE	YSJ	N1			
15	OCWA	60	21	41	1	8.9	1015	0810	GEG	CLZ	H2			
16	BCCH	63	21	01	1	10.8	✓	0900	KML	CLZ	H2			
17	BCCH	65	22	01	1	11.5	✓	✓	✓	✓	C1			
18	BCCH	64	21	01	2	11.4	✓	1011	✓	ABM	N3			
19	BCCH	66	11	01	0	10.5	✓	1055	GEG	KML	D4			
20	BCCH	65	11	01	1	10.5	✓	✓	✓	✓	✓			
21	BCCH	65	21	01	0	11.4	✓	✓	✓	✓	✓			
22	BCCH	63	21	01	4	11.0	1016	0930	ACM	APB	C1			
23	BCCH	62	21	01	4	11.1	✓	0944	✓	✓	C1			
24	SCJU	76	11	41	1	18.1	✓	1200	SID	CCT	E2			
25	BCCH	63	21	01	3	10.9	1019	1044	KML	ACM	H1			

***Figure 3**: Example of a banding data sheet.*

10. Census

Unlike banding, the census can be done in almost any weather and with a single observer, providing a standardized snapshot of the day's bird activity regardless of conditions. The census is run every day during the MMP for 60 minutes along a fixed route that samples most of the Observatory's area, beginning at 45.43077°, -73.93822° and continuing counter-clockwise to 45.42914°, -73.93714°, as shown in Figure 2. A suggested time budget for census is as follows: 10-15 minutes from the banding station to the northern end of the fence, 5 minutes to the north end of the B/N nets, 15 minutes to C, 10 minutes to the start of the M nets, 10-15 minutes to the end of the M nets and 5 minutes to the end of the census trail. On a given day, the censuser may spend more time than usual at spots on the route that are 'busy' that day, but to compensate must spend less time at other spots. The objective is to get a standardized snapshot of total activity across the count area, even if that requires leaving some detected individuals unidentified. All of the route must be given at least some attention and the full length of the route should be covered in as close to one hour as possible.

The census starts one hour after sunrise and is run each day regardless of weather conditions. During summer and winter, census follows the same route, but the time and duration may be flexible in relation to weather conditions and staff availability. The start of the census may be delayed by up to one hour if required by weather or to process captured birds safely. It may be further delayed by an electrical storm. If the census must be interrupted for any reason, it should be resumed from the place it was halted as soon as possible and the departure from the protocol noted on the daily log sheet. If necessary due to a shortage of staff, the BIC may conduct the census in parts with a net round in between, but the delay should be no more than one hour, and it should be described in the daily log.

The censuser must take along binoculars and should have a notebook and pencil or a cellphone to record observations as they occur. At the beginning of census, local weather conditions should be noted, including temperature, wind, and cloud cover (see instructions in Section 12). A spotting scope should not be used on census.

The census should be rotated among all staff familiar with most species likely to be encountered. The same person should not do the census every day. If additional staff are available, a second person may join in the census but only one person should do the counting. The censuser may step off the path to see a bird more clearly, may retrace his or her steps for up to 10 m and may 'pish' to attract birds. However, the use of any recorded sounds or other lures is forbidden. 'Pishing' in the immediate vicinity of open nets (i.e., within about 10 m) is also prohibited. At a few points on the census, the route passes sections of net lines. The censuser should move through these areas quickly

and quietly and leave netted birds alone. However, (s)he may use judgement to stop to remove birds requiring immediate attention, IF qualified as an extractor and in possession of bird bags. If there is an unanticipated influx of birds at a net and available staff are unlikely to be adequate, the censuser may temporarily halt the census to help with extraction, again only if (s)he is qualified to do so. Birds seen in nets are not counted on the census.

11. General Observations

General observations record birds detected in the count zone apart from those captured or censused. Some general observations will likely duplicate those recorded during banding or the census. The unduplicated total of birds observed by all methods is sorted out in the process of determining DETs (section 12).

Staff are encouraged to make observations throughout the count period (see Table 2). More observations can and should be made when banding is slower and when extra observers are available. Additional observations are especially important when rain or wind preclude banding. Conversely, when banding is very busy, there may be limited time for general observations. Effort should be made on those days to specifically target areas poorly covered by census and net rounds. 'Pishing' may be used to attract birds for observation; however, as with the census, no recorded sounds or other devices may be used and there should be no 'pishing' within about 10 m of open mist nets. Staff are encouraged to record all observations in notebooks or cellphones. If they must leave the site before the DETs are tallied, they must give their observations to the BIC or any other available staff member.

12. Daily Estimated Total (DET)

DETs are tallied by all staff available at the end of the daily count period. As one of the key sets of data captured by the MMP, DETs must be done in a consistent manner. The DET applies only to the count zone; any noteworthy observations made outside the count zone may be recorded as incidental sightings in the appropriate section of the daily log but not on the DET sheet.

The DET coordinator will often be the BIC, or else an experienced individual appointed by the BIC. To facilitate a smooth DET tally, the totals of newly banded birds, repeats (birds last captured within the previous 90 days) and returns (birds last captured >90 days earlier), and results of the census should be entered on the DET sheet before the tally begins. The rare occurrence of a foreign recovery should be recorded on the DET sheet as a return with an asterisk accompanied by an explanatory footnote. Figure 4 shows an example of a completed DET sheet. To help avoid duplication of census observations with banding and general observations, it is particularly desirable that the censuser be available for DET compilation.

Starting with the first species on the DET list, the DET coordinator asks for general observations. Anyone presents who saw or reliably heard individuals of the named species from the count zone during the count period will state the maximum number of individuals they detected. Other persons that observed this species join in with their reports. A brief discussion focuses on the time, location, direction of movement (and if relevant, the behaviour) of the observed birds to arrive at a consensus estimate which the DET coordinator records. In general, estimates should be conservative, but not overly so. Birds 'known' to be in the area but not actually detected on that day are not counted.

Next, for the same species, the coordinator reads aloud the numbers, if any, of individuals banded, repeats, returns, and observed on census. Whenever a species is detected by more than one method, discussion among all observers will sort out the best estimate of the number of individuals involved, to be recorded in the DET column.

The PKS (possible or known stopover) column was originally introduced to help analysts separate residents from migrants but was eventually found to be ineffective for that purpose. However, the column has been retained to allow the ongoing presence of individuals to be flagged. This can apply to rarities (e.g., repeated sightings are unlikely to be different individuals), birds with distinct individual characteristics (e.g., injury or unusual plumage), or individuals showing clear evidence of local breeding (e.g., repeatedly visiting a box or other nest). Note that the PKS should not be used to adjust the number of individuals observed or DET.

While the description of the DET tally may sound time consuming, in practice the routine quickly becomes familiar, and the average DET tally only takes 10-15 minutes. It is the responsibility of all staff the make the DET as complete and accurate as possible; however, it is particularly important that the coordinator leading the DET tally encourages the staff to provide concise and accurate observations. Off-topic discussion should be limited as it can distract the coordinator and make the DET needlessly long to complete.

The DET number for a species cannot exceed the sum of general observations, banding (newly banded, repeats, and returns) and census. However, the DET will often be less than the sum of those numbers once adjusted for likely double counting. If a single bird or small number of individuals of some group (e.g., a single owl or 3 sparrows) is unidentified as to species, they can be written in the blank lines at the end of the species list. These data will generally not be used in subsequent analysis. Therefore, staff are strongly encouraged to identify birds at the species level whenever possible. Nevertheless, it is more useful to know that a non-trivial number of birds remained unidentified than to have them left off the DET sheet altogether.

***Figure 4**: Example of a completed DET sheet*

McGill Bird Observatory - Migration Monitoring Program
Daily Estimated Totals (DET)

DOW	DAY	MONTH	YEAR
MON	10	SEP	2019

CENSUS BY:	BHM
DET RECORDED BY:	GEG

COUNT PERIOD	
Start: 0600	Stop: 1200

Species	Obs	Cns	Bnd	Rep	Ret	PKS	DET
Snow Goose							
Cackling Goose							
Canada Goose	1						1
Wood Duck							
Blue-winged Teal							
Northern Shoveler							
Gadwall							
American Wigeon							
Mallard							
American Black Duck							
Northern Pintail							
Green-winged Teal							
Ring-necked Duck							
Greater Scaup							
Lesser Scaup							
White-winged Scoter							
Black Scoter							
Hooded Merganser							
Common Merganser							
Red-breasted Merganser							
Ruffed Grouse							
Wild Turkey							
Pied-billed Grebe							
Rock Pigeon							
Mourning Dove							
Yellow-billed Cuckoo							
Black-billed Cuckoo							
Common Nighthawk							
Chimney Swift							
Ruby-throated Hummingbird	1						1
Virginia Rail							
Sora							
Sandhill Crane							
Killdeer							
Least Sandpiper							
American Woodcock							
Wilson's Snipe							
Spotted Sandpiper							
Solitary Sandpiper	1					1	0
Greater Yellowlegs							
Lesser Yellowlegs							
Ring-billed Gull							
Herring Gull							
Great Black-backed Gull							
Common Tern							
Common Loon							
Double-crested Cormorant							
American Bittern							
Great Blue Heron							
Great Egret							

Species	Obs	Cns	Bnd	Rep	Ret	PKS	DET
Green Heron							
Black-crowned Night-Heron							
Turkey Vulture							
Osprey							
Golden Eagle							
Northern Harrier							
Sharp-shinned Hawk	1	1					2
Cooper's Hawk							
Northern Goshawk							
Bald Eagle							
Red-shouldered Hawk							
Broad-winged Hawk							
Red-tailed Hawk							
Rough-legged Hawk							
Eastern Screech-Owl							
Great Horned Owl							
Barred Owl							
Northern Saw-whet Owl							
Belted Kingfisher							
Yellow-bellied Sapsucker							
Red-bellied Woodpecker							
Downy Woodpecker	2	2					3
Hairy Woodpecker		1					1
Pileated Woodpecker		2					2
Yellow-shafted Flicker	2	1					3
American Kestrel							
Merlin							
Peregrine Falcon							
Olive-sided Flycatcher							
Eastern Wood-pewee							
Yellow-bellied Flycatcher							
Alder Flycatcher							
Traill's Flycatcher							
Willow Flycatcher							
Least Flycatcher							
Eastern Phoebe							
Great Crested Flycatcher							
Eastern Kingbird							
Blue-headed Vireo							
Philadelphia Vireo							
Warbling Vireo							
Red-eyed Vireo		2	2				4
Northern Shrike							
Blue Jay	5	3					8
American Crow	22	27					40
Common Raven							
Black-capped Chickadee	12	19		2		2	21
Tufted Titmouse							
Horned Lark							
N. Rough-winged Swallow							

DOW	DAY	MONTH	YEAR
MON	10	SEP	2019

DET PARTICIPANTS:

Band data computerized:	
DET computerized:	

Species	Obs	Cns	Bnd	Rep	Ret	PKS	DET
Purple Martin							
Tree Swallow							
Bank Swallow							
Barn Swallow							
Cliff Swallow							
Golden-crowned Kinglet							
Ruby-crowned Kinglet			1				1
Red-breasted Nuthatch	1						1
White-breasted Nuthatch							
Brown Creeper							
Blue-gray Gnatcatcher							
House Wren	1	2	1	1		1	4
Winter Wren							
Marsh Wren							
Carolina Wren							
European Starling		35					35
Gray Catbird	4	4	1	1		1	5
Brown Thrasher							
Northern Mockingbird							
Eastern Bluebird							
Veery							
Gray-cheeked Thrush							
Bicknell's Thrush							
Swainson's Thrush							
Hermit Thrush							
Wood Thrush							
American Robin	4	1					5
Bohemian Waxwing							
Cedar Waxwing	13	2					15
House Sparrow							
American Pipit							
Evening Grosbeak							
Pine Grosbeak							
House Finch							
Purple Finch	1						1
Common Redpoll							
White-winged Crossbill							
Pine Siskin							
American Goldfinch	7	21					25
Snow Bunting							
Chipping Sparrow							
Field Sparrow							
American Tree Sparrow							
Fox Sparrow							
Dark-eyed Junco							
White-crowned Sparrow							
White-throated Sparrow	14	5	3	3		3	15
Vesper Sparrow							
Savannah Sparrow							
Song Sparrow	3	6	2	2		2	11
Lincoln's Sparrow			2				2
Swamp Sparrow							

Species	Obs	Cns	Bnd	Rep	Ret	PKS	DET
Eastern Towhee							
Bobolink							
Eastern Meadowlark							
Baltimore Oriole							
Red-winged Blackbird							
Brown-headed Cowbird							
Rusty Blackbird							
Common Grackle	2	10					12
Ovenbird			1				1
Northern Waterthrush			1				1
Black-and-white Warbler							
Tennessee Warbler							
Orange-crowned Warbler							
Nashville Warbler							
Connecticut Warbler							
Mourning Warbler							
Common Yellowthroat	4	4	3				7
American Redstart			1	1		1	1
Cape May Warbler			1				1
Northern Parula							
Magnolia Warbler				1		1	0
Bay-breasted Warbler							
Blackburnian Warbler							
Yellow Warbler							
Chestnut-sided Warbler							
Blackpoll Warbler		1					1
Black-throated Blue Warbler							
Western Palm Warbler							
Yellow Palm Warbler							
Pine Warbler							
Yellow-rumped Warbler							
Black-throated Green Warbler							
Canada Warbler							
Wilson's Warbler		1					1
Scarlet Tanager							
Northern Cardinal	2	2					4
Rose-breasted Grosbeak	1						1
Indigo Bunting							
# OF INDIVIDUALS			19	11	-		
# OF SPECIES	22	22	12	7	-	7	33

13. Coverage Codes

The coverage code (Table 3) reflects the extent of effort during the standard count period and can be used to facilitate subsequent data analysis.

Table 3: *Coverage codes*

Code	Term	Description
0	None	No bird coverage at all during the count period
1	Casual	Census only, or other limited casual observations
2	Poor	Census plus limited observations and/or banding
3	Fair	Census plus moderate coverage through banding and/or observations
4	Good	Census and good coverage through banding and/or observations, with either a full score for banding or observations, or a ¾ score for both
5	Excellent	Census and excellent coverage through banding and observations

The coverage code is the sum of three factors (Table 4). Record both the actual coverage code and the maximum code that would have been possible with more Class 1 observers, to distinguish loss of coverage due to weather versus understaffing. Note that census is a stand-alone component and is not included in observer hours. For example, if three people run the census and no banding or additional observation occurs that day, the coverage code is 1. The maximum coverage code for a census-only day would be 3, as an unlimited number of Class 1 observers conducting additional observations would score 2 in addition to the census score of 1.

Table 4: *Key to coverage code scoring*

Category	Points
Census	1 point if conducted, 0 if not
Banding	0.5 points for 1 to 24.9 net hours 1 point for 25 to 49.9 net hours 1.5 points for 50 to 74.9 net hours 2 points for 75+ net hours (standard maximum is 80)
Observations*	0.5 points for 0.5 to 2.9 hours 1 point for 3 to 5.9 hours 1.5 points for 6 to 8.9 hours 2 points for 9+ hours

** Observer hours are calculated as the sum of Class 1 observer hours plus 50% of Class 2 observer hours. Although Class 3 observers are encouraged to also observe, it is relatively infrequent that they spot birds not also noted by Class 1 and/or 2 observers, and therefore their hours are omitted from this total, to prevent it from being artificially inflated.*

Example 1: there is full banding coverage, and census was completed. Three observers (one of each class) each spent 3 hours observing. The actual coverage code is 4 (1 for census, 2 for banding, and 1 for observations, based on a total of 4.5 hours = 3 x 1 + 3.x 0.5). The maximum coverage code is 5 because it could have been achieved with extra observers.

Example 2: all nets were closed after one hour due to rain and could not be reopened. However, census was done, and there were three Class 1 birders on hand all day, each spending four hours observing. Both the actual and maximum coverage codes are 3.5 (1 for census, 0.5 for banding based on 16 net hours, and 2 for observations based on 12 observer hours).

14. Daily Log Sheet

The BIC must ensure that the MMP daily log sheet is completed every day, based on data collected throughout the count period. However, it is the responsibility of all participants to provide information for the log and to record it as the day progresses and time permits. Figure 5 shows an example of a completed daily log sheet.

The daily log records:

- date
- local weather conditions at the start of the count period, at the start of census, and at the end of the count period:
  - Cloud cover (in 10% increments) and wind force according to the Beaufort scale (Table 5) should be estimated on site.
  - Precipitation type (e.g., rain, drizzle, snow, hail) and intensity (e.g., intermittent, light, heavy), based on conditions observed on site.
  - Barometric pressure and temperature should be filled in based on online weather station data from the last 24 hours at P.E. Trudeau Airport. (http://www.theweathernetwork.com/weather/CAQC0023)
- A summary of weather during the preceding 12 hours (i.e., a reflection of conditions for nocturnal migrants)
- times of standard net openings and closings and any supplemental effort (e.g., hummingbird banding)
- actual and maximum coverage codes
- names of all staff present, specifying the BIC and censuser(s)
- observer class for each staff member (see Table 1), and hours of active general observations by each staff member (excluding time on extractions, banding and census

- a summary for the day of the number of species recorded by different means and the number of individuals banded, followed by a cumulative totals for the current season
- unusual species occurrences, including early and late records
- evidence of migration
- casualties or injuries
- notes about station maintenance
- explanation of notable operational deviations (e.g., net hours shortened because of rain)
- general highlights of the day / additional relevant information

If weather or any other factors require deviation from the normal MMP protocol, the log must describe what was done and why. Informative narratives are encouraged.

Table 5: *Beaufort scale*

Force	Description	Signs	Km/hr
0	Calm	Smoke rises	0-1
1	Light air	Smoke drifts but no wind vane movement	2-5
2	Slight breeze	Wind felt on face; leaves rustle	6-11
3	Gentle breeze	Leaves and twigs in constant motion; wind extends a light flag	12-19
4	Moderate breeze	Dust and loose paper are raised; small branches are moved	20-28
5	Fresh breeze	Small trees and leaves begin to sway	29-38
6	Strong breeze	Large branches in motion; whistling in wires	39-49
7	High wind	Whole tree in motion	50-61

***Figure 5**: Example of a completed daily log sheet*

McGill Bird Observatory (MBO) Migration Monitoring Program Daily Banding Log – Page One

DOW	Day	Month	Year	Day #	BIC	Census by:	Daily Log by:	Actual coverage code	4.5
Mon	10	Sept	2019	41	GEG	BHM	GEG	Max. coverage code	5

	Start	Stop
Count Period	0600	1200
Census	0725	0825

Weather Summary:
Cold weather yesterday and largely overcast.
Cold overnight but warming in AM and sunny.

	Start of Opening Round	Census	End of Count Period
Time	0600	0725	1200
Wind Direction	N	N	E
Wind Strength	1	1	1
Cloud Cover %	5	20	5
Temp. ◦C	10	14	19
Precipitation	-	-	-

Obs Initials	Observer Name	Begin Time	End Time	Hours Obs	Class	Total Obs	
GEG	Gay Gruner	0600	1200	3.5	1	x 1 =	3.5
ACM	Ana Morales	0600	1200	3.5	1	x 1 =	3.5
BHM	Betsy McFarlane	0725	0825	-	1	x - =	
						x =	
						x =	
						x =	
						x =	
						x =	
						x =	
						x =	
						x =	
						x =	

* Total Obs hours = (Class 1 x 1) + (Class 2 x 0.5) **Total Observer Hours** 7

	Species	Indiv.
Banded	12	19
Repeats	7	11
Returns	-	-
Census	22	
General Obs.	22	
DET	35	
Total net hours		80
Birds/ 100 net hours		23.8
Seasonal Cumulative Totals		
Banded	58	813
Returns	11	37
DET	113	
Total net hours		2634.3
Birds / 100 net hours		30

Net Group	Open	Closed	Net hours		
A	0605	1105	5	x 2.0 =	10
B/N	0600	1100	5	x 4.0 =	20
C	0600	1100	5	x 2.0 =	10
D	0615	1115	5	x 4.0 =	20
E	0610	1110	5	x 2.0 =	10
H	0610	1115	5	x 2.0 =	10
H-trap	-	-	**HT trap hours = 2**		

Visitors and Others:
Short visit from Malcolm Johnson to clear a fallen tree.

Deviations from Protocol:

MBO Migration Monitoring Program
Daily Banding Log – Page Two

DOW	Day	Month	Year	Daily log by:
Mon	10	Sept	2019	GEG

Station Notes:

Narrative:
Not too much to report. Most of the birds arrived during the 1st round, leaving the rest of the
Morning feeling decidedly quiet. Despite it being warm, fall is here, announced by the 1st RCKI
in the nets! No sign of yesterday's VESP though.

Bird Migration:
WTSP flocks

Newly-arrived and Unusual Species:					
Year obs:		**Year band:**		**Year rep:**	
Season obs:	**RCKI**	**Season band:**	**RCKI**	**Season rep:**	
	Year ret:		**Season ret:**		

Other Flora and Fauna:
Cicada removed from E2
Garter snake along path from D

Station Management:
Tidied up white board in station.

Injuries and Casualties:
N/A

Birds Released at Nets:
AMRO flew out of D2 as we approached

15. Habitat Management

A complete Habitat Assessment following the MAPS Protocol (DeSante *et al.*, 2015) should be done every 5 years starting in 2021 or right after any significant changes happen. The assessment should be done in the last week of July just before the fall MMP begins. Results should be stored on the MBO computer in files named "Habitat assessment [habitat patch name] [year] MBO" in a folder called "Habitat Assessment," and a copy should be sent to Birds Canada for archiving at the same time as bird data for the year are submitted.

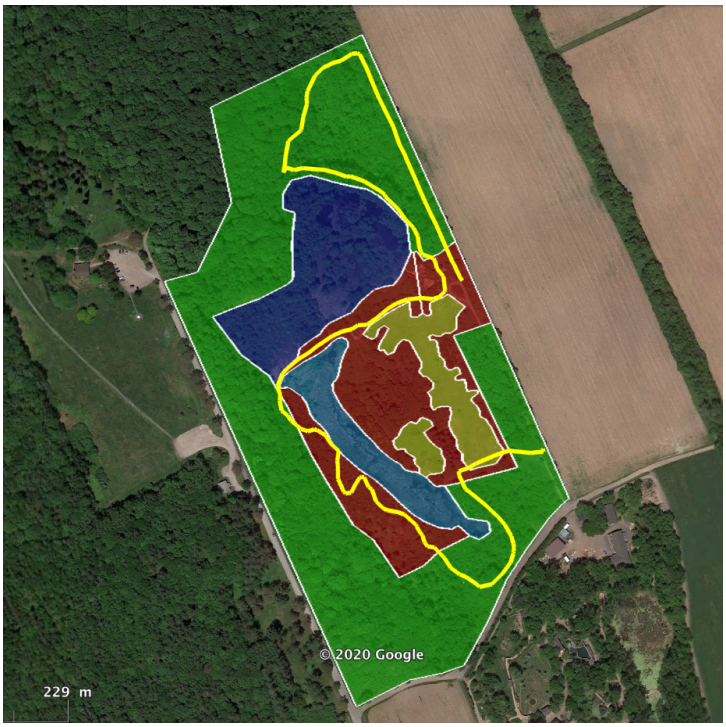


Figure 6: *Map of McGill Bird Observatory, showing major habitat types: mature deciduous forest (green), second growth / shrubland with hawthorn patches, sumac stands, and scattered apple trees (red), open field with mix of grasses, goldenrods, raspberries, milkweed (gold), Stoneycroft Pond, dominated by cattails (light blue), and shrubby swamp, flooded in spring (dark blue).*

a) Photographic records

Photographs of the vegetation surrounding each MMP net and at various locations along the census route were taken in late summer 2004 to serve as a reference point for future years and the same set of photos have been taken almost every year since for comparison. The object is to facilitate maintenance of habitat consistency over time, to the extent possible. Starting in 2020, net photos are to be taken at the beginning of each season from both ends of each net lane, looking

along the net (i.e., providing a view of the vegetation along and beyond the net from both perspectives). Photos along the census route (waypoints MBO_A to MBO_Z, Appendix B) are to be taken once every 3 years at the beginning of the fall season (Week 1) starting in 2020. Photos should be named: "MBO Net A2 2 Aug 2020" or "MBO MBO_A 2 Aug 2020" and stored in two specific folders: "MBO Net Photos" and "MBO Site photos" so they can be compared easily. Photos taken in previous years will be labeled and archived to the same folders.

b) Habitat maintenance

Vegetation management is most critical below and adjacent to all nets. As much as possible, vegetation around the net lanes should be kept at the same general height over time. The B/N nets are within mature forest, so the primary objective there is to aim for consistency in the density of sub-canopy vegetation near the nets. However, most of the other nets are among hawthorns, sumacs, apples, or other shrubs and low trees, that require periodic trimming or thinning out. This should be done annually and gradually, to avoid substantial changes from one year to another, with care to avoid excessive trimming that could increase the visibility of nets to birds and differentially affect capture rates over time. Periodically (every two to three years to date) the cattails in Stoneycroft Pond need to be manually thinned out during the summer when the water levels are low to ensure that they do not overtake the pond.

16. Record of changes or major interruptions in standardized data collection

Every MMP protocol has this section. It informs researchers when certain data must be interpreted with care because bird counts may have changed without any actual change in numbers present. Important interruptions to operations should be noted (e.g., flooding or lack of personnel that reduced effort for periods of a week or more), as well as any permanent changes to data collection methods. Although operational changes are sometimes necessary (as when a netting location is destroyed), changes in data collection are not to be made unless absolutely necessary and should preferably be discussed in advance with the CMMN Science Committee.

Any standardized operational change or interruption occurs is to be added to the table below, underneath any previous entries. Refer to parts of the text that were changed (e.g., section number, altered locations on a map, new GPS points). Revise the 'latest version' date on page 1 of this protocol. If changes have been made to the protocol other than adding to the table below, submit a copy of the entire revised protocol to Birds Canada along with year-end data submission; otherwise, send only a copy of the table.

***Table 6**: Changes and exceptions to the protocol over time*

Date	Description of change and justification (if applicable)
Spring 2005	Nets A1, B2-3, C1-2, D1-3, E1 and H1 added; 2004 pilot net locations F1 and F3 retired (GPS locations available in MBO archives)
Fall 2005	G1 and G2 tested most days over the first half of the season, but discontinued because of distance/time required to monitor effectively
Spring 2006	Nets A2, E2, and H2 were added in spring 2006 and have remained in use ever since.
2006	Nets K1-K2 and L1-L2 were tested daily during much of May and August but had very low capture rates and were discontinued.
2006	Two original 18-m nets that had been used at A1 and D1 were replaced with 12-m nets, reducing the capture potential of those nets. However, the difference was likely small enough to not affect calculation of birds/net-hr across years.
2007	Census route set up in 2004 was shortened by ~200 m in fall 2007 to enable it to be comfortably completed within 60 minutes. The final section that passed through the centre field and along part of the access road was omitted, as the area is reasonably well covered by general observations. 2007 is the first year of standardized data collection for trend analysis.
2008	The PKS (Probable/Known Stopover) field was added to the DET sheet to document individuals that were counted on previous days. Previous records (2004-2007) were then revisited to ensure adherence to the PKS system to avoid double-counting of individuals (e.g. repeats and rarities shifted to PKS and excluded from multi-day DETs).
2013	Removed a J-trap that was located between nets A and C, and was operational from late 2007 to 2012. Numbers had been included as standard captures but were so low as to have a negligible impact on season totals.
2015	Fall coverage extended from 13 weeks (August 1 to October 30) to 14 weeks (ending November 6). Dates of coverage are accounted for in routine trend calculations.
2020	Spring program curtailed due to Covid-19 pandemic restrictions. Daily census completed, but no banding or other observations possible.

17. Acknowledgements

The MBO protocol was originally adapted by Marcel Gahbauer and Marie-Anne Hudson from the November 1998 Innis Point Spring Migration Monitoring Program Protocol by Bill Murphy. Dick Cannings from Vaseux Lake Bird Observatory provided an excellent summary of the PKS issue, for which we are grateful.

18. References

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Appendix A. Bander's Code of Ethics

1. Banders are primarily responsible for the safety and welfare of the birds they study so that stress and risks of injury or death are minimized. Some basic rules:

- handle each bird carefully, gently, quietly, with respect, and in minimum time
- capture and process only as many birds as you can safely handle
- close traps or nets when predators are in the area
- do not band in inclement weather
- frequently assess the condition of traps and nets and repair them quickly
- properly train and supervise students
- check nets as frequently as conditions dictate
- check traps as often as recommended for each trap type
- properly close all traps and nets at the end of banding
- do not leave traps or nets set and untended
- use the correct band size and banding pliers for each bird
- treat any bird injuries humanely

2. Continually assess your own work to ensure that it is beyond reproach.

- reassess methods if an injury or mortality occurs
- ask for and accept constructive criticism from other banders

3. Offer honest and constructive assessment of the work of others to help maintain the highest standards possible.

- publish innovations in banding, capture, and handling techniques
- educate prospective banders and trainers
- report any mishandling of birds to the bander
- if no improvement occurs, file a report with the Banding Office

4. Ensure that your data are accurate and complete, are submitted in a timely fashion to the responsible agency or organization and are appropriately used to advance valid scientific purposes.

5. Obtain prior permission to band on private property and on public lands where authorization is required.

Appendix B. Photo reference points

Net poles:

A1: 45.42998°, -73.93940° / 45.42994°, -73.93925°
A2: 45.42988°, -73.93920° / 45.42980°, -73.93910°
B2: 45.43169°, -73.93966° / 45.43131°, -73.93896°
B3: 45.43162°, -73.93934° / 45.43167°, -73.93948°
C1: 45.43020°, -73.93997° / 45.43011°, -73.94015°
C2: 45.43009°, -73.94018° / 45.43002°, -73.94034°
D1: 45.42965°, -73.93955° / 45.42954°, -73.93946°
D2: 45.42951°, -73.93944° / 45.42941°, -73.93931°
D3: 45.42941°, -73.93931° / 45.42932°, -73.93920°
D4: 45.42949°, -73.93941° / 45.42949°, -73.93961°
E1: 45.42945°, -73.93862° / 45.42940°, -73.93853°
E2: 45.42957°, -73.93867° / 45.42956°, -73.93855°
H1: 45.43080°, -73.93875° / 45.43087°, -73.93895°
H2: 45.43067°, -73.93880° / 45.43064°, -73.93894°
N1: 45.43131°, -73.93896° / 45.43143°, -73.93906°
N3: 45.43152°, -73.93916° / 45.43162°, -73.93934°
O1: 45.42939°, -73.93857° / 45.42934°, -73.93871°
O2: 45.42934°, -73.93871° / 45.42924°, -73.93861°
O3: 45.42924°, -73.93861° / 45.42918°, -73.93847°
O4: 45.42919°, -73.93843° / 45.42926°, -73.93832°
O6: 45.42921°, -73.93839° / 45.42911°, -73.93832°
V3: 45.43019°, -73.93826° / 45.43016°, -73.93853°
V4: 45.43016°, -73.93853° / 45.42997°, -73.93849°
V5: 45.42998°, -73.93844° / 45.43014°, -73.93828°

Census waypoints:

MBO_A 45.430744°, -73.938172°, North, South
MBO_B 45.431365°, -73.938583°, North, South
MBO_C 45.432064°, -73.939036°, North, South
MBO_D 45.432868°, -73.939542°, East, South, West
MBO_E 45.432222°, -73.940327°, North, South
MBO_F 45.431802°, -73.940238°, East, South
MBO_G 45.431006°, -73.938717°, North, South, West
MBO_H 45.430788°, -73.938472°, South, West
MBO_I 45.430633°, -73.938417°, East, South, West
MBO_J 45.430301°, -73.939475°, North, East, South, West
MBO_K 45.429860°, -73.940589°, East, South, West
MBO_L 45.429250°, -73.939980°, North, East, South, West
MBO_M 45.428770°, -73.939778°, North, East, South
MBO_N 45.428732°, -73.939359°, North, East, South, West
MBO_O 45.428559°, -73.939152°, North, East, South
MBO_P 45.428505°, -73.938885°, North, East, South, West
MBO_Q 45.428232°, -73.938543°, North, South, West
MBO_R 45.428222°, -73.937486°, North, East
MBO_S 45.428930°, -73.938222°, East, West
MBO_T 45.429081°, -73.937825°, North, East, South, West
MBO_U 45.429137°, -73.937118°, North, South, West
MBO_V 45.429134°, -73.938894°, North, East, South, West
MBO_W 45.429891°, -73.939585°, North, East, South, West
MBO_X 45.430105°, -73.938527°, North, East, South, West
MBO_Y 45.429728°, -73.938415°, North, East, South, West
MBO_Z 45.429293°, -73.938274°, North, East, South, West

Appendix C. Codes for skulling and fat scoring.